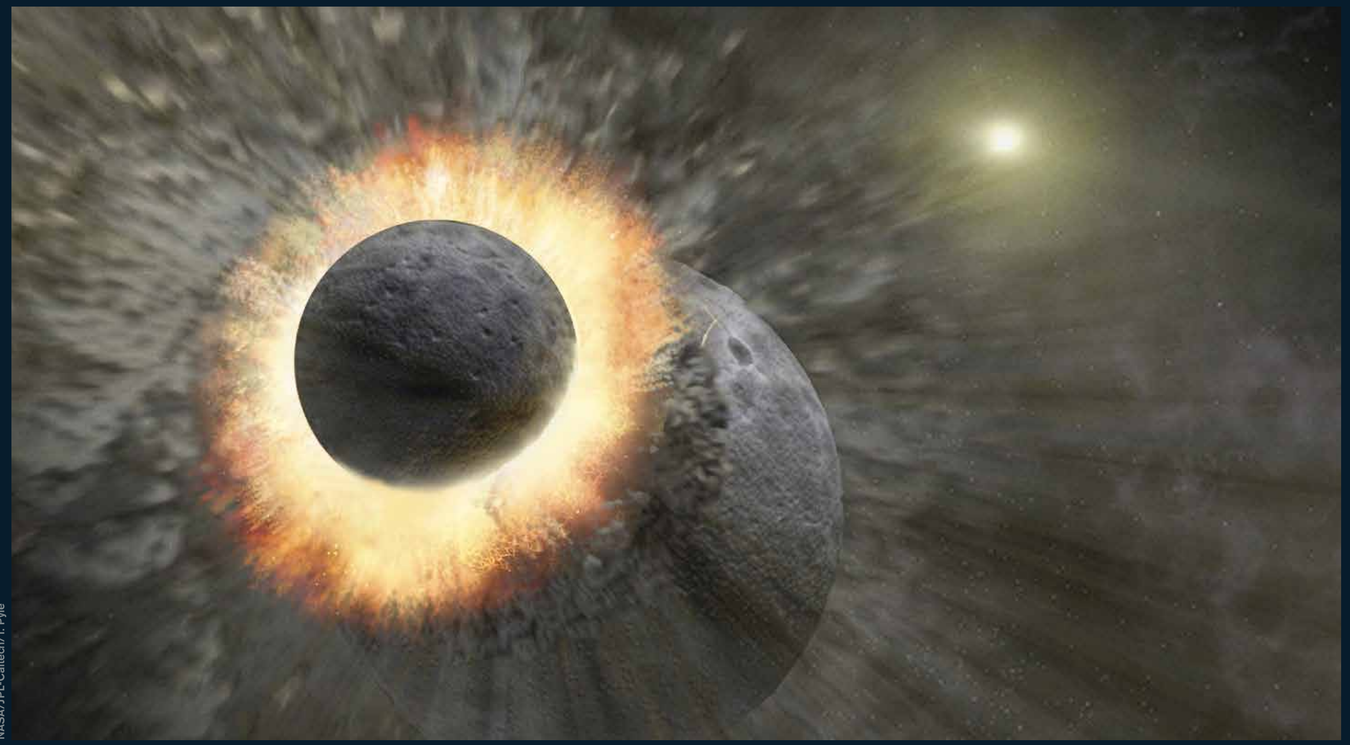
STATION 04 Formation of the Earth and its Moon



NASA/JPL-Caltech/T. Pyle

THE MOON-FORMING EVENT: The impact of a Mars-sized protoplanet vaporized proto-Earth's upper layers and ejected large amounts of solid debris that later accreted to form the Moon. This impact also caused Earth's axis to be tilted at an angle that is responsible for Earth's seasons.

The proto-Earth accreted about 4.56 billion years ago in the protoplanetary disk, and the Moon-forming event occurred about 50 million years later. Molten rock covered the fresh new Earth, but it cooled quickly. Analysis of ancient gems called zircons shows that a water ocean existed by 4.3 billion years ago.

THE MOON-FORMING COLLISION
This iconic object represents a collision between the proto-Earth and a Mars-sized protoplanet. The ejected material formed an Earth-orbiting debris disk that later accreted into the Moon.

Big Bang — 4.5 billion years ago — Present

Newly Formed Earth was Hot

Courtesy Fahad Sulehria/ novaceleste.com

MOLTEN ROCK COVERED THE NEW EARTH: This image depicts Earth's magma ocean after the Moon-forming event: exposed molten rock is yellow or red, while cooler solidified lava crust is black. No life could exist then.

Detailed simulations suggest that much of Earth's original atmosphere was likely lost in the impact event, and more was later blown off because of the high heat.

This primordial atmosphere contained almost no oxygen and would have been toxic to humans and most modern life.